Executive Summary

The Integrated Airborne Reconnaissance Strategy

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Introduction

This document presents a strategy for developing a comprehensive, integrated and efficient airborne reconnaissance capability; one that, in concert with space-based assets, will meet the needs of the warfighter through 2010. It introduces the goal of *extended reconnaissance*—the ability to supply responsive and sustained intelligence data from anywhere within enemy territory, day or night, regardless of weather, as the needs of the warfighter dictate. This document is a top level description of the functions, system elements, and interfaces that comprise the future architecture for *extended reconnaissance*. This *Objective Architecture* is a blueprint for an interoperable system that will be flexible and scalable. It consists of a balanced mix of manned and unmanned platforms supported by an efficient global information infrastructure to minimize redundant data collection and expedite the delivery of reconnaissance data with particular emphasis on the direct connection between the sensors and the warfighters. To achieve this goal, the document presents a systematic approach for selecting, developing and deploying the specific airframes, sensors, communications, and information technologies that will be required to transition from the current capability to the Objective Architecture. The approach is built on a vision that addresses the realities of a changing global and fiscal environment and responds to Congress (emphasis added):

> "The committee, therefore, directs the Secretary of Defense, in coordination with the Director of Central Intelligence, to **provide an integrated airborne reconnaissance strategy** for the post-cold war era..."
>
> House Armed Services Committee
> 30 July 1993

> "In addition, the conferees direct the Under Secretary of Defense for Acquisition and Technology, in coordination with the Assistant Secretary of Defense for Command, Control, Communications and Intelligence, to submit a report to the congressional defense committees on these issues by April 1, 1994. The report should include a description and explanation of the Administration's **outyear plans and recommendations.**"
>
> Conference Report on the Defense Authorization Act
> 10 Nov 1993

The Defense Airborne Reconnaissance Office

On 6 November 1993, the Deputy Secretary of Defense created the Defense Airborne Reconnaissance Office (DARO) to unify existing airborne reconnaissance architectures and enhance the management and acquisition of manned and unmanned airborne assets. The DARO was tasked to assess the airborne reconnaissance needs of the U.S. through

2010 and develop and implement the strategy to meet those needs in a timely and cost-effective manner.

Overall reconnaissance is the shared responsibility of many organizations. While the DARO serves as the Office of Primary Responsibility (OPR) for airborne reconnaissance, the development and execution of an action plan for meeting reconnaissance requirements will be done in collaboration with OPRs for weapons, Imagery Intelligence (IMINT), Signals Intelligence (SIGINT), Measurements and Signatures Intelligence (MASINT), and Human Intelligence (HUMINT).

Changing Requirements

With the end of the Cold War, the emphasis on strategic warfare is diminishing. The nature of future conflict will not be focused or be predictable in its location, but will manifest itself in near-simultaneous regional conflicts requiring rapid deployment and action under a broad variety of environmental and political conditions. The elimination of a single major threat, coupled with the problems of weapons proliferation, numerous volatile regional situations, and distributed instances of ethnic conflict, combine to shift the thrust of surveillance and warning from a specialized, redundant set of stovepipes narrowly focused on a two-sided scenario toward a much more unpredictable and varied mix of contingencies.

Future conflicts will reflect the diversity of operational environments encountered in Panama, DESERT STORM, Somalia, and Bosnia. In order to contend with the broad range of warfighting operations characteristic of those conflicts, we must modify our force structure and make fundamental changes in the manner in which information is gathered and distributed to the warfighter. While the reconnaissance capabilities of the United States were critical in expediting a decisive victory and minimizing casualties in DESERT STORM, that experience emphasized the enormous potential that could be realized through further improvements in our reconnaissance capability. For example, events in DESERT STORM demonstrated that the demand for reconnaissance information is not only driven by the nature and distribution of conflict, but also by the information requirements of advanced weaponry. We learned that the information required to exploit the full capabilities of precision guided weapons is far more exacting than that required for conventional munitions.

In addition to changes in information requirements to support warfighting, there will be an increasing number of new applications for reconnaissance resources. Airborne systems, and Unmanned Aerial Vehicles (UAVs) in particular, will be used for environmental measurements to aid in our understanding of global processes (climate change, ozone depletion, etc.). The U-2R has already been used to support the Federal Emergency Management Agency (FEMA) during floods in the Midwest, fires in Malibu, and Hurricane Andrew. In addition, the monitoring of arms transfers, the open skies treaty, proliferation activities, the drug trade, and other events that affect national goals must be taken into consideration when defining a future airborne reconnaissance architecture. Conversely, civilian resources are becoming available that could be brought to bear on supplying information to the warfighter. For example, the Administration recently approved

the launch of commercial satellites that will provide imagery with 1-meter resolution. These products will also be available to support military reconnaissance needs.

It is important to recognize that world events will continue to evolve in an unpredictable manner. Thus it is not sufficient to define some rigid reconnaissance mechanism that will address a fixed set of anticipated scenarios. Instead, it is essential to develop an architecture that is adaptable and evolvable so as to meet unanticipated requirements in a timely and cost effective manner.

Improving the Airborne Reconnaissance Capability

Significant changes in the mechanism for acquiring and distributing reconnaissance information will have to be made in order to meet future demands. The changes will have to be substantial and will require radical modification to the manner in which reconnaissance systems are designed, developed and integrated. However, with improved and more expeditious methods of acquiring and disseminating critical information that includes the capability of transmitting reconnaissance information directly into the war-fighter's cockpit, combat vehicle, or combat vessel, we can expect to fight more decisively, effectively, and efficiently over the range of conflicts anticipated through 2010.

In order for the United States to be prepared to fight anywhere in a timely and efficient manner, there must be significant growth in available reconnaissance data without overwhelming the warfighter. The Executive Branch and the Congress will need more tailored information to avert conflict while the warfighters will require nearly-perfect real-time knowledge of the battlefield to fight effectively with minimal loss of life. In combination, these requirements translate into the following collection needs:

- Hundreds to thousands of point targets per day
- Broad area coverage of thousands of square kilometers per day
- Mapping, charting, and geodesy of thousands of square kilometers per day
- Total imagery coverage of tens of thousands of square kilometers per day
- All-weather, day/night coverage
- SIGINT, MASINT, and HUMINT for situation awareness and focus

More than 85% of our reconnaissance assets were employed in DESERT STORM to meet only a fraction of this requirement. It is obvious from that experience that future requirements will exceed our current capacity to collect, process and exploit information.

Specific experiences in DESERT STORM highlighted areas for improvement in our current reconnaissance capability. The stratified nature of today's systems was evident in the number of discrete systems deployed during that conflict: 33 unique IMINT systems (14 of which were not interoperable), 18 different SIGINT systems, a unique acoustic intelligence system, three radar intelligence (RADINT), and three MASINT systems. Our ability to retrieve previously collected intelligence was such that it was generally easier to re-task the platform than to find the product in the theater data base. The need for a long-endurance, broad area coverage reconnaissance capability

was demonstrated by the significant number of U-2R aircraft we had to employ to maintain two continuous orbits. In addition, AWACS based in Turkey could not communicate with AWACS based in Saudi Arabia due to a lack of in-theater over-the-horizon communications. Finally, the increasing usefulness of UAVs was demonstrated—over 150 Pioneer IMINT UAVs flew in excess of 3,000 sorties.

These experiences from DESERT STORM, coupled with lessons learned in Somalia and Bosnia, indicate that a number of specific improvements to our airborne reconnaissance capability would provide significant benefits to the warfighter. These improvements include:

- Continuous broad area coverage
- Improved sensor data for Battle Damage Assessment (BDA)
- Increased bandwidth capability for secondary imagery dissemination
- Better information retrieval and distribution of intelligence data
- Improved over-the-horizon communications for reconnaissance elements
- Better information to support warfighter situation awareness
- High resolution IMINT and SIGINT to support precision strikes
- Reconnaissance coverage that is synchronized with the warfighter.

Many of these improvements can be achieved by migrating from the current stovepiped and non-interoperable systems to a more unified reconnaissance architecture supported by an efficient, integrated information infrastructure. A key aspect of the future system is a sharp focus on getting information directly to the warfighter. Future systems must be designed to get the required information to the combatant when he needs it. This must be done in a timely, consistent and accurate manner. Information must be derived from appropriate sources and made available to match the needs of individual platforms and the timing and type of mission.

We will also have to minimize redundant data collection and significantly increase data availability and access across both the national and airborne communities. In the future, our airborne capability must be integrated with the national community through various means—including the Requirements Management System (RMS)—that support requirements integration and mission planning. The ability to exploit reconnaissance data in a distributed manner, coordination in collection, and effective means of accessing the national inventory of previously collected data, will contribute significantly to meeting future coverage requirements in a cost-effective manner.

The Objective Architecture

In constructing the Objective Architecture, the fundamental goal of the DARO— to serve the warfighter—was applied. The DARO has carefully analyzed the functional requirements for reconnaissance coverage under a range of battle conditions as well as in peacetime. We have compared these requirements to the capabilities of existing sensors, platforms, and information distribution capabilities and have derived an architecture for achieving coverage requirements through 2010. The architecture will:

- Consolidate and integrate the current fleet of platforms, and introduce UAVs for steerable, long dwell, synoptic coverage
- Emphasize Synthetic Aperture Radar (SAR) as the imaging baseline for its all weather capability, reducing dependence on photo reconnaissance for broad area coverage
- Provide a coordinated, high capacity, integrated information storage, retrieval and distribution infrastructure (including the Common Data Link (CDL) family and in-theater satellite relays compatible with *C^4I for the Warrior*) that is wideband, highly responsive, and provides timely information to the warfighter
- Consolidate ground stations into multi-user access, multi-INT (IMINT, SIGINT, MASINT and HUMINT) distributed systems
- Utilize multidiscipline interactive cueing where SIGINT cues imagery and imagery cues SIGINT in support of integrated theater data bases to increase useful information while reducing wasteful sensor coverage
- Operate across the full range of threats and conflicts: small to large, conventional to weapons of mass destruction, including information war.

Figure A illustrates these goals of the Objective Architecture. It also depicts the migration path from today's stovepiped architecture to the unified, modular, and flexible *extended reconnaissance* system for the future. It illustrates improved coordination with national systems and strong connectivity with the *C^4I for the Warrior* concept.

As the architecture evolves, we will enact significant changes in process, priorities and direction of our reconnaissance force mix. For example, we will rely more on off-the-shelf technologies, prototyping, and streamlined acquisition initiatives. We will make efficient use of resources to meet prioritized requirements and resist the temptation to let costs grow to meet a complex, diverse, open-ended threat. Advanced Concept Technology Demonstrations (ACTDs) will be crucial in bridging the technology transition gap and marrying user needs with emerging technology opportunities. We will drive toward dual-use technologies to maximize the return from our mission assets. We will be consistent with, but not constrained by, acquisition rules and regulations.

We will be cognizant of other resources and attempt to maximize the efficiency of our interfaces to those capabilities. We will strive to complement, not duplicate, coverage provided through national assets. We will also rely on our allies to provide reconnaissance capability during coalition warfare.

In order to maximize collection efficiency, our architecture will utilize a common information infrastructure that will facilitate coordination with national activities and provide rapid access to previously collected reconnaissance information. This global grid connection will be completely compatible with commercial digital technology and capable of interfacing with legacy systems. The infrastructure will be based on emerging international communications standards to allow digital interactive pull to satisfy individual combatant needs. We will establish a data acquisition and retrieval structure that will increase the warfighter access to previously collected data from airborne, as well as other assets, minimizing duplicative tasking and expediting the delivery of pertinent information to the field.

The sensors, platforms, and information components of our architecture will be modular and flexible to facilitate fast, efficient configuration and deployment across a range of contingencies. By maximizing data digitization at the sensor, the architecture will facilitate integration between weapons systems, surveillance assets, and communications resources. This structure will allow direct communications between the sensors and the warfighter, and give the warfighter direct access to data from both airborne and space-based assets.

The DARO plans to significantly improve coupling between reconnaissance and weapons systems. In order to support the Joint Direct Attack Munitions (JDAM), TriService Standoff Attack Missile System (TSSAMS), Brilliant Anti-Tank (BAT), Multiple Launch Rocket System (MLRS), Tomahawk and Joint Standoff Weapons System programs (in which the services are investing over $8B), we will enhance geolocation for precision guided munitions and ensure a rational basis for data acquisition to insure consistency between the needs of these systems and collected reconnaissance information. Improved imagery, cross-discipline cueing, and real-time communications will all contribute to providing the timely, high-resolution information required to exploit the capabilities of future weapons systems.

This section has summarized our current view of how to migrate today's reconnaissance assets into a more capable, but less costly, force for the year 2010. The Objective Architecture, however, is an evolving blueprint that will ultimately incorporate inputs from the overall architecture authority of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD(C^3I)). The process by which the final Objective Architecture will be integrated with these other authorities is shown in Figure B. These activities include those of the National Reconnaissance Office (NRO), the National Security Agency (NSA), the Central Imagery Office (CIO), and the Central MASINT Office (CMO). Although not shown in the figure, the J-6/DISA *C^4I for the Warrior* and the CIA/DoD's HUMINT architectures will be included in our coordination efforts. The figure illustrates the process and feedback associated with the evolution of the DARO's Objective Architecture and how it will ultimately lead to the formulation of an investment strategy.

In summary, the DARO will facilitate and contribute to appropriate tradeoffs among reconnaissance support plans, weapons specifications, and concepts of operations. The geolocation accuracy requirements for precision guided munitions become key determinants of future reconnaissance capabilities.

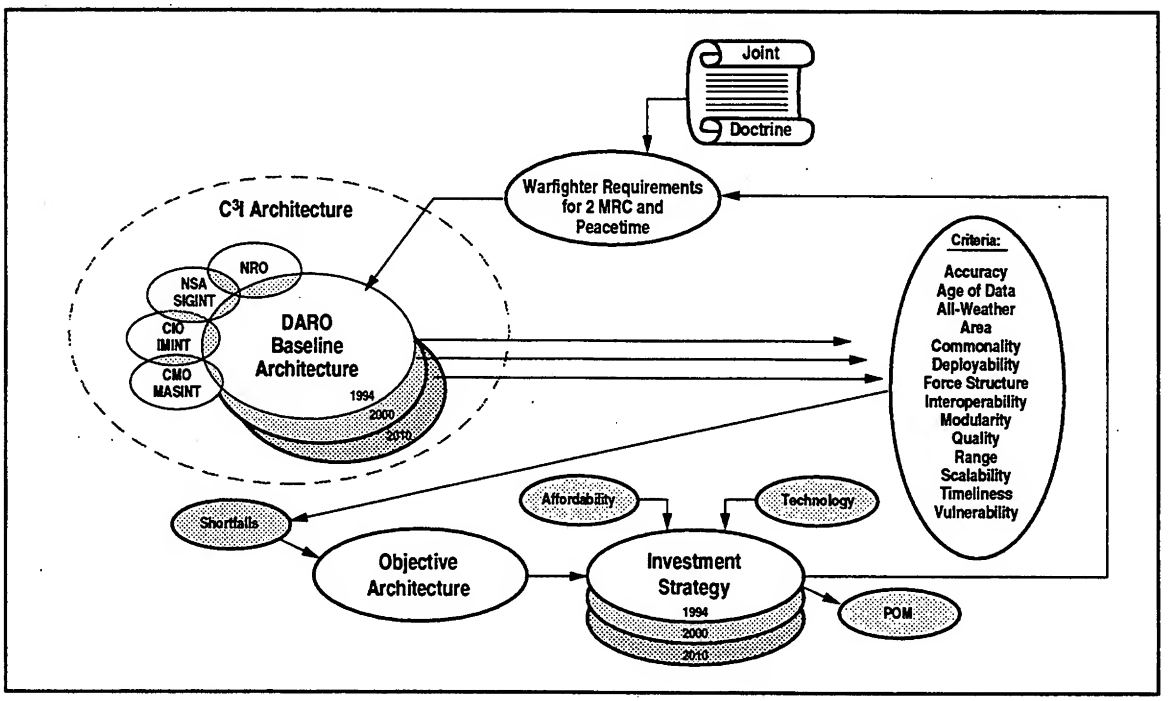

Figure B: The DARO Approach Builds On Community Participation

Investment Strategy and Planning

Bringing the Objective Architecture from a concept to a deployed functional system requires a detailed plan of action. This plan must consider the resources available to the DARO for its execution—a total of $9.23B over the current five-year period. Identifying the set of potential architectural components and alternatives—sensors, platforms, communications systems and information processing and dissemination components—and then selecting the best mix of those components will be the products of an *investment strategy* that the DARO will develop over the next year.

In developing the investment strategy, we plan to maximize the use of Commercial-Off-The-Shelf (COTS) technologies in achieving our architectural goals. We will monitor and empower the industrial base to leverage available state-of-the-art technologies. However, we will not hesitate to apply investment in areas where commercial markets fall short, including platform and sensor technology.

Every effort will be made to exploit advanced technology in the operational architecture. We will be sensitive to the potential offered by high-payoff technologies such as SAR, wide bandwidth tactical communications links, low-cost airborne platforms and high-performance compact computing. However, the benefits of advanced technologies, and the sensitivity of those benefits to development uncertainties, will be evaluated carefully prior

to their inclusion in the final reconnaissance architecture. If a new, but unproven, technology offers real benefit over existing approaches, the investment strategy may dictate limited investment in the new technology with simultaneous investment in a more established alternative. If prototyping and demonstration can prove the viability of the new technology, investment in the existing system will be terminated and shifted to the new technology. Thus, the investment strategy is likely to include decision points during the course of the overall activity, which will direct or modify future investment activity based upon the outcome of intermediate events.

In addition to technology trade-off, ACTDs will provide Commanders-in-Chief and their senior staff with a means of evaluating new systems and information flows, and a better understanding of the means of getting information where it needs to go—to the warfighter. Better understanding of emerging technology and information will allow the warfighter to refine his operational procedures and doctrine to comprehensively utilize available reconnaissance assets and to develop future requirements.

The investment strategy developed by the DARO will result in the selection of a complementary mix of airborne reconnaissance assets and an associated information structure that, in combination with national and other systems, will meet the overall reconnaissance needs of the DoD.

Formulating an Investment Strategy

The process of formulating an effective investment strategy is complex and requires consideration of a broad range of requirements and technical options. The DARO has begun this process with a comprehensive definition of the reconnaissance requirements for a broad range of peacetime and battle situations. This activity, coupled with careful evaluation of migration systems, has led to the definition of architectural concepts that define the class of system components for consideration in an investment strategy. Given these investment directions, we anticipate the following steps in formulating an investment strategy:

1. **The set of architecture components must be identified and characterized.** The Objective Architecture concept described in this document, and the specific program actions taken to date, will bound the set of system components—new and existing sensors, platforms, and information technologies—that will be considered as candidates for inclusion in the final architecture. Each component considered for inclusion in this portfolio will be characterized with respect to contribution, cost, and risk. However, the selection process will ultimately consider each architecture element in the context of its contribution to the complete asset mix as opposed to its independent performance and cost characteristics.
2. **The candidate components will be aggregated under a decision process.** This selection process will find a subset of those system and component alternatives, that together and in combination with national assets, will meet

the functional reconnaissance and information distribution requirements presented in this report while minimizing development cost and migration risk. It is our objective to develop a capability that is both effective and efficient to operate. Minimizing the expected cost of operating and maintaining the total reconnaissance capability will factor heavily in this selection process.

3. **A time-ordered plan will be developed.** This plan will list the sequence of individual investments and actions that will be taken to develop and integrate the selected system components to achieve the goal architecture by the target date. It will sequence events with consideration of potential development and acquisition risks and delays.

Unanticipated technological advances as well as technical setbacks will undoubtedly be encountered during the development and migration process. The DARO investment strategy, as approved by the DARSC, will be structured to be adaptable to such events. However, the investment plan will be continuously evaluated and periodically adjusted in order to exploit and manage events during the development and acquisition cycle.

Conclusion

We have created a new vision for airborne reconnaissance. There are many hurdles and risks inherent in the transition from the current reconnaissance regime to the new architecture. However, the Congress has been extremely supportive of this vital mission area and we anticipate that they will continue to do so if we manage our affairs responsibly. The ability to prevail in future conflicts necessitates connecting all elements of the battle space—on land, sea, air, and in space—to provide the warfighter with the information required to win decisively, efficiently, and, most importantly, with minimal loss of life.

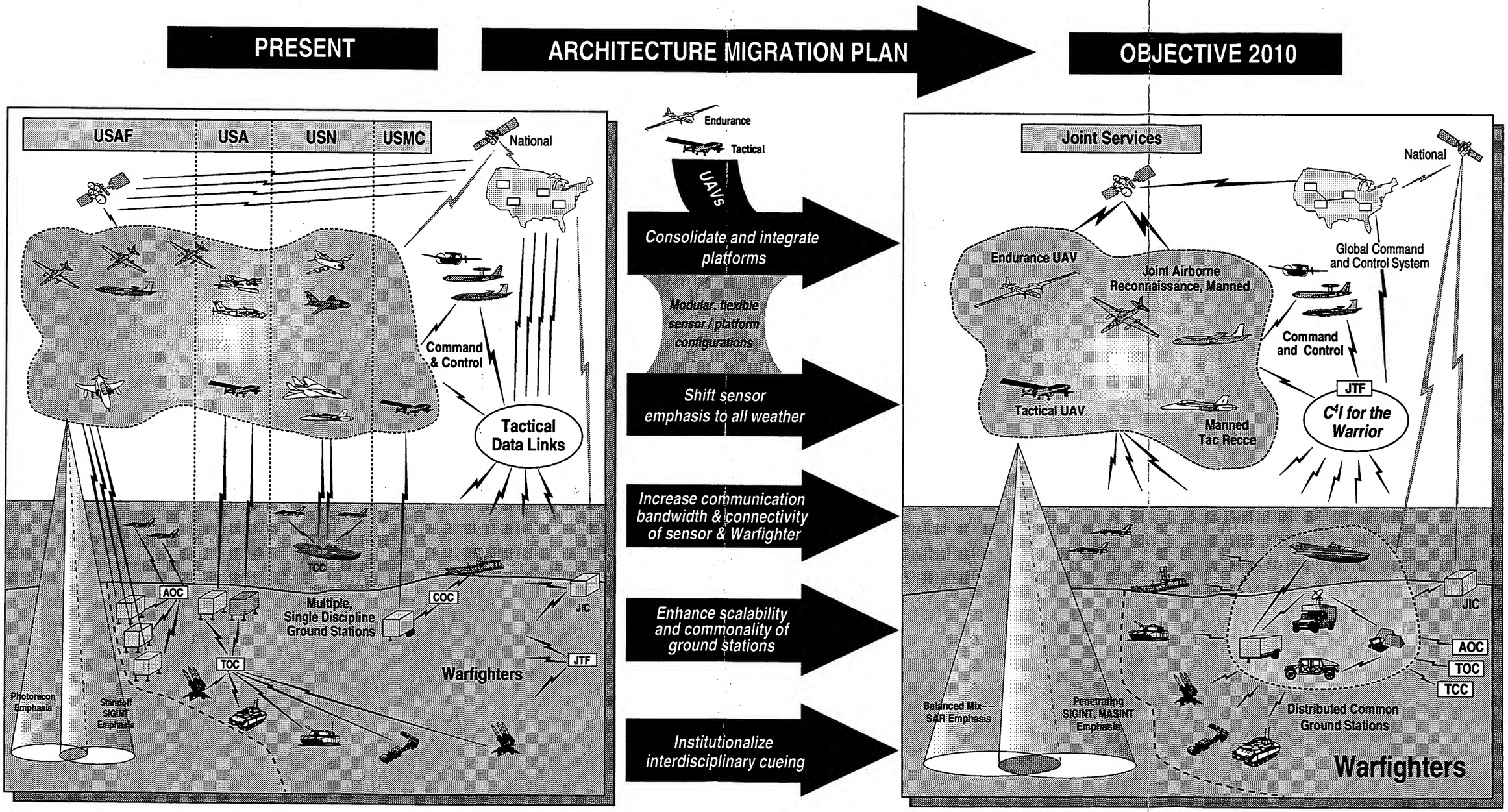

Figure A: The Integrated Airborne Reconnaissance Strategy — An Architecture Migration Plan for the Year 2010